

Programmers Aid for ATARI® Computers \$3.98 copyright 1982

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M-WD INC.

BASIC KEYWORDS

Word	Token	Word	Token
ABS	79	Next	9
ADR	67	NOT	40
AND	42	NOTE	27
ASC	64	ON	30
ATN	68	Open	23
Bye	14	OR	41
CLOAD	53	PADDLE	81
CHR\$	62	PEEK	70
CLOG	76	PLOT	44
CLOSE	17	Point	28
CLR	18	POKE	31
Color	3	POP	39
COM	16	POSITION	45
CONt	15	PRint	32
COS	69	PTRIG	83
CSAVE	52	PUT	42
Data	1	RAD	33
DEg	19	READ	34
DIm	20	Rem	0
DOs	46	REStore	35
DRAwto	47	RETurn	36
END	21	RND	72
Enter	5	RUn	37
EXP	74	Save	25
For	8	SEtcolor	48
FRE	73	SGN	78
GET	41	SIN	71
GOSub	12	SOUND	50
Goto	10	SQR	77
GRaphics	43	STatus	26
IF	7	STEP	26
Input	2	STICK	82
INT	80	STRIG	84
LEN	66	STOP	38
LEt	6	STR\$	61
List	4	THEN	27
LOAd	24	TO	25
LOCate	49	Trap	13
LOG	75	USR	63
LPrint	51	VAL	65
NEW	22	Xio	29

MUSICAL NOTES

PITCH VALUES

high notes	C	29
	B	31
	A# or Bb	33
	A	35
	G# or Ab	37
	G	40
	F# or Gb	42
	F	45
	E	47
	D# or Eb	50
	D	53
	C# or Db	57
	C	60
	B	64
	A# or Bb	68
	A	72
	G# or Ab	76
	G	81
	F# or Gb	85
	F	91
	E	96
	D# or Eb	102
	D	108
	C# or Db	114
	C	121
	B	128
	A# or Bb	136
	A	144
	G# or Ab	153
	G	162
	F# or Gb	173
	F	182
	E	193
	D# or Eb	204
	D	217
	C# or Db	230
low notes	C	243

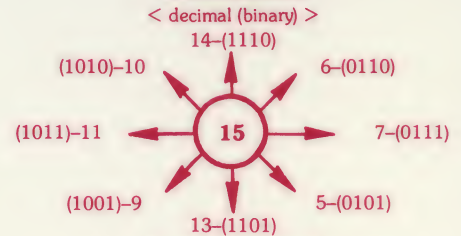
ERROR MESSAGES

Code	Message
2	Memory Insufficient
3	Value Error
4	Too Many Variables
5	String Length Error
6	Out of Data Error
7	Number greater than 32767
8	Input Statement Error
9	Array or String DIM Error
10	Argument Stack Overflow
11	Floating Point Overflow/Underflow Error
12	Line Not Found
13	No Matching FOR Statement
14	Line Too Long Error
15	GOSUB or FOR Line Deleted
16	RETURN Error
17	Garbage Error
18	Invalid String Character
Input/Output Errors	
19	LOAD Program Too Long
20	Device Number Larger
21	LOAD File Error
128	BREAK Abort
129	IOCB
130	Nonexistent Device
131	IOCB Write Only
132	Invalid Command
133	Device or File not Open
134	Bad IOCB Number
135	IOCB Read Only Error
136	EOF
137	Truncated Record
138	Device Timeout
139	Device NAK
140	Serial Bus
141	Cursor Out of Range
142	Serial Bus Data Frame Overrun
143	Serial Bus Data Frame Checksum Error
144	Device Done Error
145	Read after Write Compare Error
146	Function not Implemented
147	Insufficient RAM
160	Drive Number Error
161	Too Many OPEN Files
162	Disk Full
163	Unrecoverable System Data I/O Error
164	File Number Mismatch
165	File Name Error
166	POINT Data Length Error
167	File Locked
168	Command Invalid
169	Directory Full
170	File not Found
171	POINT Invalid

ATARI HUES

Value	Color	Value	Color
0	Grey	8	Blue
1	Gold	9	Light Blue
2	Orange	10	Turquoise
3	Red-Orange	11	Green-Blue
4	Pink	12	Green
5	Purple	13	Yellow-Green
6	Purple-Blue	14	Orange-Green
7	Blue	15	Light Orange

JOYSTICK



OPERATORS

highest precedence:

Token	Oper.	Meaning
50	<	Relational operators used in string expressions
51	>	
52	=	
47	<=	
49	>=	
48	<>	Relational operators used in numeric expressions
54	-	
35	^	
36	*	
39	/	
37	+	Addition
38	-	Subtraction
32	<	Relational operators used in numeric expressions
33	>	
34	=	
29	<=	
31	>=	
30	<>	Unary Operator
40	NOT	
42	AND	
41	OR	

DEFAULT COLORS

SETCOLOR register	Color value	Lum value	Color
0	2	8	Orange
1	12	10	Green
2	9	4	Dark Blue
3	4	6	Pink
4	0	0	Black

MODE/COLOR TABLE

Color	Mode	SETCOL.	COLOR	Application
--	Mode 0 and Text Windows	0	COLOR	--
Light Green		1	deter-	Char. Luminance
Dark Blue		2	mines	Background
Black		3	character	--
		4	plotted	Border
Orange	Modes 1 and 2	0	COLOR	Character
Light Green		1	deter-	Character
Dark Blue		2	mines	Character
Red		3	character	Character
Black		4	plotted	Background, Border
Orange	Modes 3, 5, & 7 (Four color modes)	0	1	Graphics Point
Light Green		1	2	Graphics Point
Dark Blue		2	3	Graphics Point
--		3	--	--
Black		4	0	Gr. Point, Bkgd., Border
Orange	Modes 4 & 6 (Two color modes)	0	1	Graphics Point
--		1	--	--
--		2	--	--
Black		3	--	--
		4	0	Gr. Point, Bkgd., Border
--	Mode 8 1 color and 2 lum.	0	--	--
Light Green		1	1	Gr. Point Luminance
Dark Blue		2	0	Gr. Point, Background
Black		3	--	--
		4	--	Border

ADDITIONAL USER NOTES:
(USE PERMANENT MARKER TO PRESERVE)

ANTIC MODES and SCREEN FORMATS

ANTIC Opcode	BASIC Mode	Char or Bitmap	Number of Colors	X x Y ColumnsxRows	Pixel Size HorxVert	Bytes per Line/Screen
\$2 2	0	Char	2	40 x 24	8 x 8	40/960
\$3 3	--	Char	2	40 x 19	8 x 10	40/760
\$4 4	--	Char	4	40 x 24	8 x 8	40/960
\$5 5	--	Char	4	40 x 12	8 x 16	40/480
\$6 6	1	Char	5	20 x 24	16 x 8	20/480
\$7 7	2	Char	5	20 x 12	16 x 16	20/240
\$8 8	3	Bit	4	40 x 24	8 x 8	10/240
\$9 9	4	Bit	2	80 x 48	4 x 4	10/480
\$A 10	5	Bit	4	80 x 48	4 x 4	20/960
\$B 11	6	Bit	2	160 x 96	2 x 2	20/1920
\$C 12	--	Bit	2	160 x 192	2 x 1	20/3840
\$D 13	7	Bit	4	160 x 96	2 x 2	40/3840
\$E 14	--	Bit	4	160 x 192	2 x 1	40/7680
\$F 15	8	Bit	2	320 x 192	1 x 1	40/7680

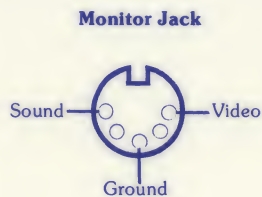
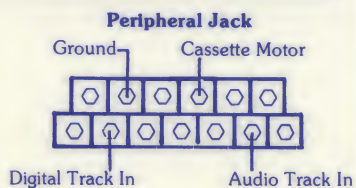
ANTIC BLANK-LINE OPCODES

Number of Blank Lines	Opcode
1	0 (\$00)
2	16 (\$10)
3	32 (\$20)
4	48 (\$30)
5	64 (\$40)
6	80 (\$50)
7	96 (\$60)
8	112 (\$70)

ANTIC INSTRUCTION MODIFIERS

Instruction Type	Scroll		LMS	DLI
	Hor	Vert		
blank lines	--	--	--	+128 (\$80)
char/graphics	+16 (\$10)	+32 (\$20)	+64 (\$40)	+128 (\$80)
JMP =1 (\$1)	--	--	--	+128 (\$80)
JVB =65 (\$41)	--	--	--	+128 (\$80)

CONNECTOR PINOUTS



FREE RAM IN PAGE ZERO

176-202 (\$B0-\$CA)	free in Assembler
203-207 (\$CB-\$CF)	free in BASIC & Assem
208-209 (\$D0-\$D1)	free in BASIC
212-255 (\$D4-\$FF)	free in Assembler

FREE RAM ELSEWHERE

1536-1791 (\$600-\$6FF), and from value in BASIC MEMTOP, 144,145 (\$90,\$91), to value in OS MEMTOP, 741,742 (\$2E5,\$2E6).

OPERATING SYSTEM ENTRY POINTS

Label	decimal-Location-hex	Function
DSKINV	58448 E450	Disk Handler init
DISKV	58451 E453	Disk Handler
CIOV	58454 E456	Central I/O utility
SIOV	58457 E459	Serial I/O utility
SETVBV	58460 E45C	Set System Timers
SYSVBV	58463 E45F	First stage VBLANK
XITVBV	58466 E462	Exit VBLANK
SIOINV	58469 E465	SIO utility init
SENDEV	58472 E468	Send enable
INTINV	58475 E46B	Interrupt Handler init
CIOINV	58478 E46E	CIO utility unit
BLKBDV	58481 E471	Memo Pad mode
WARMSV	58484 E474	Warmstart (RESET button)
COLDVS	58487 E477	Coldstart (power-up)

FLOATING POINT ROM ENTRY POINTS

AFP	55296 D800	ASCII to FP conversion
FASC	55526 D8E6	FP to ASCII conversion
IFP	55722 D9AA	Integer to FP conversion
FPI	55762 D9D2	FP to Integer conversion
ZFRO	55876 DA44	Clear FP register 0
ZF1	55878 DA46	Clear FP number
FSUB	55904 DA60	Floating Point Subtract
FADD	55910 DA66	Floating Point Add
FMUL	56027 DADB	Floating Point Multiply
FDIV	56104 DB28	Floating Point Divide
PLYEVL	56640 DD40	FP Polynomial Evaluation
FLDOR	56713 DD89	Load FP number
FLDOP	56717 DD8D	Load FP number
FLD1R	56728 DD98	Load FP number
FLD1P	56732 DD9C	Load FP number
FSTOR	56743 DDA7	Store FP number
FSTOP	56747 DDAB	Store FP number
FMOVE	56758 DDB6	Move FP number
EXP	56768 DDC0	FP Base e Exponentiation
EXP10	56780 DDCC	FP Base 10 Exp.
LOG	57037 DECD	FP Natural Logarithm
LOG10	57041 DED1	FP Common Logarithm

IMPORTANT MEMORY LOCATIONS---RAM

Label	decimal-Location-hex	Function
RTCLCK	18,19,20 12,13,14	Internal Clock
ICxxx	32-47 20-2F	Page Zero IOCB
SOUNDR	65 41	Noisy I/O flag (0=quiet)
ATTRACT	77 4D	Attract Mode flag (128=Attract Mode)
LMARGIN	82 52	Left Margin (default=2)
RMARGIN	83 53	Right Margin (default=39)
ROWCRS	84 54	Current Graphics Cursor Row
COLCRS	85,86 55,56	Current Graphics Cursor Column
CRMODE	87 57	BASIC Graphics Mode (0-8)
SAVMSC	88,89 58,59	Lowest Address of Screen Memory
OLDROW	90 5A	Previous Graphics Cursor Row
OLDCOL	91,92 5B,5C	Previous Graphics Cursor Column
NEWROW	96 60	Row to which DRAWTO will go
NEWCOL	97,98 61,62	Column to which DRAWTO will go
RAMTOP	106 6A	Actual Top of RAM (in pages)
LOMEN	128,129 80,81	BASIC Low Memory pointer
VNTP	130,131 82,83	Variable Name Table beginning address
VNTD	132,133 84,85	Variable Name Table ending address+1
VVTP	134,135 86,87	Variable Value Table address
STMTAB	136,137 88,89	Statement Table address
STARP	140,141 8C,8D	String Array Table address
MEMTOP	144,145 90,91	BASIC Top of Memory Used pointer
STOPLN	186,187 BA,BB	Line Number of STOP or TRAP
ERRSAVE	195 C3	Error Number causing STOP or TRAP
PTABW	201 C9	PRINT Tab Width (default=10)
FRO	212-217 D4-D9	Floating Point Register 0
FR1	212,213 D4,D5	Value returned by USR function
VDSLST	224,229 E0-E5	Floating Point Register 1
VBREAK	512,513 200,201	Display List Interrupt Vector
CDTMV1-5	518,519 206,207	BREAK Vector
VVBLKI	536-545 218-221	System Timer 1-5 values (low,high)
VVBLKD	546,547 222,223	Vert. Blank Int. vector (immediate)
CDTMA1	548,549 224,225	Vert. Blank Int. vector (deferred)
CDTMA2	550,551 226,227	System Timer 1 time-out jump address
CDTMF3-5	552,553 228,229	System Timer 2 time-out jump address
SDMCTL	554,6,8 22A,C,E	System Timer 3-5 time-out flags
SDLSTL	559 22F	DMA enable (0=off) shadow
LPENH	560,561 230,231	Display List Pointer shadow
LPENV	564 234	Light Pen Horizontal Position
COLDST	565 235	Light Pen Vertical Position
GPRIOR	580 244	1 = Coldstart on RESET
PADDLO-7	623 26F	Priority Control shadow
STICKO-3	624-631 270-277	Values of Paddle 0-7
STRIGO-3	632-635 278-27B	Values of Joystick 0-3
TXTRGW	644-647 284-287	Joystick Button 0-3 (0=pressed)
TXTCOL	656 290	Text Cursor Row
TXTMSC	657,658 291,292	Text Cursor Column
BOTSCR	660,661 294,295	Top left corner of Text Window
PCOLOR-3	703 2BF	Number of Text Rows (0,4, or 24)
COLORO-4	704-707 2C0-2C3	Color of Player/Missile 0-3
MEMTOP	708-712 2C4-2C8	SETCOLOR registers 0-4
MEMLO	741,742 2E5,2E6	OS Top of Memory pointer
CRSINH	743,744 2E7,2E8	OS Bottom of Memory pointer
CHACT	752 2F0	Cursor Inhibit (0=cursor on)
CHBAS	755 2F3	Character Mode Register
CH	756 2F4	Character Set Base Register
	764 2FC	Last Key Pressed (internal code)

IMPORTANT MEMORY LOCATIONS---HARDWARE REGISTERS

(XXX) indicates RAM shadow address	W=write	R=read
HPOSP0-3	53248-53251 D000-D003	W-Player 0-3 Horizontal Position
M0-3PF	53248-53251 D000-D003	R-Missile 0-3/Playfield Collision
HPOSM0-3	53252-53255 D004-D007	W-Missile 0-3 Horizontal Position
P0-3PF	53252-53255 D004-D007	R-Player 0-3/Playfield Collision
SIZEP0-3	53256-53259 D008-D00B	W-Size of Player 0-3
M0-3PL	53256-53259 D008-D00B	R-Missile 0-3/Player Collision
SIZEM	53260 D00C	W-Sizes for Missiles
P0-3PL	53260-53263 D00C-D00F	R-Player 0-3/Player Collision
GRAFP0-3	53261-53264 D00D-D010	W-Player 0-3 Graphics Data
TRIGO-3	53264-53267 D010-D013	R-(644-647) Joystick Button 0-3
GRAFM	53265 D011	W-Graphics for Missiles
COLPM0-3	53266-53269 D012-D015	W-(704-707) Player/Missile 0-3 Color
COLPFO-3	53270-53273 D016-D019	W-(708-711) Playfield 0-3 Color
COLBK	53274 D01A	W-(712) Background Color & Lum
PRIOR	53275 D01B	W-(623) Priority Control
VDELAY	53276 D01C	W-Vertical Delay
GRACLT	53277 D01D	W-Graphics Control
HITCLR	53278 D01E	W-Clear the Collision Registers
CONSOL	53279 D01F	R-START/SELECT/OPTION Buttons
CONSOL	53279 D01F	W-Click Console Speaker
AUDF1-4	53760,2,4,6 D200,2,4,6	W-Audio Channel 1-4 Frequency
AUDC1-4	53761,3,5,7 D201,3,5,7	W-Audio Channel 1-4 Control
AUDCTL	53768 D208	W-Audio Control
KBCODE	53769 D209	R-(764) Keyboard Code
RANDOM	53770 D20A	R-Random Number Generator
PORTA,B	54016,54017 D300,D301	Controller Jacks 1 & 2
PA,BCTL	54018,54019 D302,D303	Port A and B Control
DMACTL	54272 D400	W-(559) DMA Control
CHACTL	54273 D401	W-(755) Character Control
DLISTL,H	54274,54275 D402,D403	W-(560,561) Display List pointer
HSCROL	54276 D404	W-Horizontal Scroll value
VSCROL	54277 D405	W-Vertical Scroll value
PMBASE	54279,54280 D407,D408	W-Player/Missile Base Address
CHBASE	54281 D409	W-(756) Character Base Address
WSYNC	54282 D40A	W-Wait for Horizontal Sync
VCOUNT	54283 D40B	R-Vertical Line Counter
NMIEN	54286 D40E	W-NMI Interrupt Enable